

# SYMONS'S

## MONTHLY

# METEOROLOGICAL MAGAZINE.

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### THE BRITISH ASSOCIATION AT LIVERPOOL.

FOLLOWING the precedent of previous years, we commence our report of the recent meeting with a list of those present most noteworthy for their direct and indirect contributions to the progress of meteorology in its various branches. Foremost amongst them was our distinguished Transatlantic *confère*, Professor Henry, of the Smithsonian Institution, whose "Contributions to Knowledge" so thoroughly merit their sensible title, to whom also we are indebted for "Tables Meteorological and Physical, by A. Guyot," of which we have so often had occasion to speak in the highest terms.

Ansted, Prof., D.T. .... London.	Hawksley, T., C.E.....London.
Bateman, J. F., F.R.S... ..	Howlett, Rev. F. ....Alton.
Belcher, Admiral Sir E. ....	Lawton, W. ....Hull.
Bewick, T. J., C.E. ....Allenheads.	Lewis, Capt. ....Hastings.
Birt, W. R., F.R.A.S. ....Walthamstow.	Lloyd, Rev. A. R. ....Hengoed.
Brooke, C., F.R.S. ....London.	Lowe, E. J., F.R.S. ....Nottingham.
Buchan, A., F.R.S.E. ....Edinburgh.	Lund, C. ....Bradford.
Chambers, C., F.R.S. ....Bombay.	Main, Rev. R., F.R.S. ....Oxford.
Chevallier, Rev.Pro., F.R.S.Durham.	Moffatt, T., M.D. ....Hawarden.
Curley, T., C.E. ....Hereford.	Osler, A. F., F.R.S. ....Birmingham.
Denny, H., F.L.S. ....Leeds.	Parnell, J. ....Upper Clapton.
Denton, J. Bailey, C.E....London.	Peckover, A. ....Wisbeach.
Dowson, E. T. ....Beccles.	Pengelly, W., F.R.S.....Torquay.
Elliott, Sir W. ....Wolfelee, N.B.	Perry, Rev. S. J. ....Stonyhurst.
Ellis, W. H. ....Exeter.	Phillips, Prof. J., F.R.S..Oxford.
Evans, J., F.R.S. ....Hemel Hempstead.	Scott, R. H., F.R.S. ....London.
Everett, Prof., D.C.L. ....Belfast.	Smelt, Rev., M.A., F.R.A.S.Cheltenham.
Field, R., C.E. ....London.	Smith, D., F.R.A.S. ....Birmingham.
Galton, F., F.R.S. ....	Smyth, J., C.E. ....Banbridge.
Gassiot, J. P., F.R.S. ....	Snow, Rev. H. ....Eton College.
Gilchrist, J., M.D. ....Dumfries.	Stewart, Prof. B., F.R.S.Manchester.
Glaisher, J., F.R.S. ....Blackheath.	Symons, G. J. ....London.
Hailstone, E. ....Bradford.	Talmage, C. G. ....Leyton.
Hall, J. J. ....Richmond.	Tomlinson, C., F.R.S. ....Highgate.
Hartnup, J., F.R.A.S. ....Bidston Obs.	Waterhouse, J., F.R.S....Halifax.
Hartnup, J., Jun. ....	Wilson, C. ....Garstang.

It is not generally known that the gross income of the British Association is about £2000 per annum; of this perhaps £800 goes for printing, salaries, &c., leaving £1200 or thereabouts available for

scientific purposes. Kew Observatory originally drew little more than £200 per annum, but with its increased utility for magnetic and other work, its expenditure rose, until for several years past it has drawn £600, or half of the entire sum available for scientific investigations. It is felt that a central physical observatory is an absolute necessity for this country, and it is also felt that the cost of such an establishment should not fall on the limited and fluctuating funds of the British Association. A large proportion of the time of the staff is now absorbed by the work of the Meteorological Committee and paid for by them; this already tends somewhat to make Kew rather a Government establishment than one belonging to the British Association. Moreover, though not *expressed*, we believe it has been *felt* by some of the naturalists belonging to the British Association, that the limited branches of physical science represented at Kew had somewhat of a lion's share of the income of the Association. Lastly, there is, if not the probability, at least the hope, that the Royal Commission on Science now sitting, may recommend the establishment of Kew as a National Observatory and Laboratory for the Physical Sciences.

Under these circumstances, the General Committee confirmed a resolution of the Council to the effect that they will continue the present grant to Kew for two years, and that thenceforth the connexion between the Association and Kew will cease.

Having thus concisely, but we believe accurately, explained the present prospects of Kew Observatory, we proceed with extracts from the report of the Kew Committee, so far as they touch upon Meteorology:—

*Meteorological work.*—The meteorological work of the Observatory continues in the charge of Mr. Baker.

Since the Exeter Meeting, 150 barometers have been verified, and 30 have been rejected; 1160 thermometers and 103 hydrometers have likewise been verified. 19 standard thermometers have been constructed for Professor Tait, and 2 for the Meteorological Office.

The self-recording meteorological instruments now in work at Kew will be again mentioned in the second division of this Report. These are in the charge of Mr. Baker, the photography being superintended by Mr. Page.

#### (B) WORK DONE AT KEW AS THE CENTRAL OBSERVATORY OF THE METEOROLOGICAL COMMITTEE.

"It is stated in the Report for 1867 that the Meteorological Committee had appointed Mr. Balfour Stewart as their Secretary, on the understanding that he should, with the concurrence of the Kew Committee, retain his office of Superintendent of the Kew Observatory.

"On the 8th October, 1869, Mr. Stewart resigned his appointment as Secretary to the Meteorological Committee, and Director of their Central Observatory—a step which took effect on 31st March, 1870, and which was followed by a modification of the relation between the two Committees.

"The Meteorological Committee, at their meeting on 12th November, 1869, resolved that they were prepared to make the following proposals to the Council of the British Association:—

- "I. That Kew be continued as one of the ordinary self-recording observatories, in which case the Committee would be prepared to allot to it annually £250; or,
- "II. In addition to the foregoing work, that Kew be maintained as the central observatory for examination of records and tabulations from all the other observa-

tories, in which case the Committee will be prepared to allot a further annual sum of £400.

"The Kew Committee having been furnished with this resolution of the Meteorological Committee, resolved that it be recommended to the Council of the British Association that Kew be continued for the next two years as one of the ordinary self-recording observatories of the Meteorological Committee, that body allowing it annually £250; and that, in addition, it be maintained as the central observatory for the examination of the records and tabulations from all the other observatories, for the further sum of £490 per annum. This arrangement was approved by the Council; and it was thereupon resolved by the Kew Committee, that out of the £650 received from the Meteorological Committee, £200 be given to Mr. Stewart for superintending the meteorological work of the Observatory. This resolution to take effect after 31st March, 1870.

"1. *Work done at Kew as one of the Observatories of the Meteorological Committee.*—The barograph, thermograph, and anemograph furnished by the Meteorological Committee are kept in constant operation. Mr. Baker is in charge of these instruments. From the first two instruments traces in duplicate are obtained, one set being sent to the Meteorological Office and one retained at Kew; as regards the anemograph, the original records are sent, while a copy by hand of these on tracing-paper is retained. The tabulations from the curves of the Kew instrument are made by Messrs. Baker, Page, and Foster.

"2. *Verification of Records.*—The system of checks devised by the Kew Committee for testing the accuracy of the observations made at the different observatories continues to be followed, the only alteration being that the Kew staff, at the suggestion of the Meteorological Office, have undertaken to rule on the barograms and thermograms a set of zero lines, which are of great use in pantagraphic operations.

"Mr. Rigby continues to perform the main part of this work; Mr. Baker, Meteorological Assistant, having the general superintendence of the department.

"3. *Occasional Assistance.*—The Meteorological Committee have availed themselves of the permission to have the occasional services of Mr. Beckley, Mechanical Assistant at Kew; and he has lately been visiting the various observatories of the Meteorological Committee.

"The self-recording rain gauge mentioned in last Report as having been devised by Mr. Beckley, has been adopted by the Meteorological Committee, and instruments of this kind are at present being constructed for their various observatories.

"The Staff at Kew continue to make occasional absolute hygrometrical observations by means of Regnault's instrument, with the view of testing the accuracy of the method of deducing the dew-point from the observations with the dry and wet bulb thermometers.

"Two erections have been made in the grounds adjoining the Observatory; and on one of these a large Robinson's anemometer is placed, while a small instrument of the same kind is placed on the other.

"By this means the indications of the large and those of the small-sized instrument may be compared with each other. The cost of this experiment has been defrayed by the Meteorological Committee.

"J. P. GASSIOT, *Chairman.*

"*Kew Observatory, 9th Sept., 1870.*"

#### REPORT ON LUMINOUS METEORS.

This was read by Mr. Glaisher, who, before proceeding to the immediate business deputed to him, bore testimony to the efficient services rendered to the committee by the late Professor Brayley, of London, who had contributed most important information bearing upon meteoric and astronomical science. Mr. Glaisher explained the contents of a voluminous catalogue which he laid before the meeting, embodying the proceedings of the committee upon this branch of their labours during the past year. He also acknowledged the receipt of a

long correspondence forwarded by Professor Charles Augustus Kessel-meyer, of Manchester, respecting a fireball which was seen on the Lake of Geneva, in the month of September, 1869, and was observed by other watchers in various parts of Europe, who also discovered several other gear meteors. Mr. Glaisher then read the following extracts from the appendix :—

“The appendix which follows the observations of luminous meteors, includes, as in previous years, those descriptions of large meteors which have come to the knowledge of the committee, with the exception of a large number of foreign observations of the great fireball seen in the south-west parts of Europe on the 8th of September, 1869, of which it is expected that a condensed account will be published before the preparation of another report, embodying all the principal features of its course, to which a brief allusion, with references to the original observations, is made in the present catalogue. A large number of observations of shooting stars during the August period in 1870, are also omitted from the catalogue, while the general appearances of the shower are described at length in the appendix ; and for the most part bright meteors only, and those which were found to have been doubly observed at distant places, are entered for future discussion in the catalogue. It will be seen that whereas only six fireballs were so well observed in England and Scotland during the past year as to enable their heights to be determined—on the 1st and 11th of October, 6th and 14th of November, and 12th of December, 1869, and on the 20th of August, 1870—the heights of 16 shooting stars were obtained during the meteoric showers of the 5th and 11th of August, 1870 ; and 20 shooting stars recorded at Greenwich during the same meteoric shower were so distinctly seen at other places that their real heights are at present undergoing calculation.

“During the meteoric shower of the 14th of November, 1869, the sky at places in the south of England was generally overcast ; but at the Royal Observatory, Greenwich, at Stonyhurst, and at Edinburgh, Glasgow, and Culloden, in Scotland, a clear view of the sky was obtained during a portion of the time in which the shower appeared to be at its height ; and a considerable fireball was doubly recorded by the observers at the last two stations, of which the observations and the calculated heights are contained in the catalogue and its appendix. The advantage of maintaining a watch for the phenomenon at such widely distant stations as Culloden, Glasgow, Stonyhurst, and Greenwich was the more apparent at the last return of the November star shower, since in America, on the morning of the 14th November, 1869, the sky was, throughout the United States, so completely overcast with a heavy fall of snow that no other announcement of the meteoric shower having been seen west of the European continent, with the exception of the brilliant phenomena observed in Florida and California, has hitherto been received by the committee. The observations of the same shower in Italy, at Port Said in Egypt, and at the Mauritius are described in the last appendix of the Report. Although the state of the sky was quite favourable for its observation in Italy, and partially so at the other stations, it does not appear that a distinct maximum of the shower was observed at any of those points of view ; but the number of shooting stars observed during the progress of the shower rose and fell, sometimes very rapidly, through a great range of activity and of the apparent rate of frequency of the meteors. It may be inferred from these results that the phenomenon of the November star showers is now rapidly declining in its intensity, and that the stream of the Leonids, if it should be crossed by the earth on the morning of the 14th of November in the present year, will be found to have grown diffuse, and to have scattered itself into groups of pretty frequent falling stars with intervening lulls or barren intervals, in which observers will be rewarded by the sight of very few meteors, or in which it may happen that for the space of many minutes no shooting stars will be observed.

“Following the example set by Professor Schiaparelli, of Milan, and by the Italian astronomers at Turin, Urbino, Rome, Palermo, and at other observatories in Italy, whose separate catalogues of shooting stars reported from the surrounding

stations now number many hundreds of observations, to record observations of shooting stars, as far as possible on stated nights, at such widely separated stations as to increase the visibility of any meteoric shower which might be traced, the committee have decided, with a view to ultimately co-operating in the same well-devised scheme of observations, to confine their immediate attention for the present to those nights of the year on which long-known and well-established meteoric showers are annually expected to occur; and for this purpose they have provided star charts, suitable forms of registry, and directions to observers of the meteors which annually make their appearance with more or less regularity on the 1st and 2nd of January, the 19th to the 21st of April, the 5th to the 12th (especially the 10th) of August, the 18th to the 21st of October, the 12th to the 15th of November, and the 11th to the 13th of December, on each of which meteoric dates in the coming year (as their endeavours during the August shower of this year were rewarded with very valuable results) the committee desire to renew their appeal to observers in distant parts of England to use the same ability in mapping and counting the numbers of the meteors seen on the predicted nights which continues to render these reports a valuable chronicle of observation and a work of reference for meteoric science."

The thanks of the section were cordially given to Mr. Glaisher for his interesting paper, upon which there was no discussion.

A paper containing observations on shooting stars was sent by the Rev. R. Main, but in the absence of that gentleman the paper was presented, but was not read.

#### THE REPORT OF THE RAINFALL COMMITTEE

was read by Mr. G. J. Symons, the secretary. It commenced by referring to the steps taken last year to secure uniformity in the registration of rain by the observers throughout the country, to the acceptance by the General Committee of the recommendation of the Rainfall Committee that additional observers should be obtained in parts of the country where at present such observers are far from one another. Dartmoor was last year quoted as an illustration; thither after last meeting Mr. Symons proceeded, and the result is that the number of stations in that district has been doubled. There are, however, still two parts of the moor where no one lives, and no one has yet been found willing to superintend a gauge. Reference is next made to other steps taken by the Committee to secure returns from various other districts, and to the success of these efforts. The Committee close this portion of their report by pointing out that to keep up an amateur staff adequate to the requirements of the subject, say from 1,500 to 2,000 observers, it is indispensable that a number of new ones be enlisted each year to supply vacancies caused by deaths and removals, and they therefore intimate their desire to receive through their secretary, (G. J. Symons, Esq., 62, Camden-square, London,) offers of assistance from parties willing to provide themselves with the inexpensive and simple gauge now generally in use.

The Report mentions that the secretary has during the past year visited and examined the gauges in use at upwards of one hundred stations. By this personal intercourse, greatly improved accuracy and uniformity of procedure is secured.

The Committee regret that through want of funds they have been

unable to make any progress with the collection of old returns during the past year.

The report then proceeds to describe certain experiments carried out at Calne, in Wiltshire, by Col. Ward, with a view to determining the difference in the amount of rain collected at various heights above the ground, not so much with a view to determining the cause of this variation as its amount, and therefrom the possibility or otherwise of reducing observations made with gauges at different heights above the ground to what they would have been at some uniform datum. This portion of the report commences by a brief notice of the experiments made by Prof. Phillips at York in the years 1832-35, then pass on to illustrate the necessity for the determination of these corrections; thence to a description of the instruments employed, and their position; and then follow a heavy batch of tables of the calculations and results which it is impossible to abbreviate. Part of the conclusions were exhibited in the form of diagrams representing the total rainfall on the surface of the ground, and its decrease at various altitudes above it, one diagram giving the mean annual decrease, and a series of twelve others the monthly curves; from these it was perfectly obvious that the difference between a gauge on the ground and one 20 ft. high is in winter nearly three times as great as in summer, and hence it becomes evident that the mean annual correction is applicable to the total fall in one or more years only, and not to individual months, for each of which separate corrections are given.

The report considers in the next place the most suitable height for the orifice of gauges to be above ground, and gives various reasons *pro* and *con*, finally concluding that 1 ft., as hitherto adopted, be still recommended.

The next subjects referred to are the tables in an appendix giving the monthly fall of rain at about 300 stations during the years 1868-9, and various calculations in different states of progress.

The report concludes by pointing out the great work being done by the voluntary and entirely gratuitous services of nearly 2000 observers, and suggests that it would be alike a graceful and an economical act on the part of the Government were they to offer to relieve the observers from the cost of reducing and publishing the observations which are now by their accuracy and completeness accepted as a type by foreign countries and our own colonies, and which are found yearly more and more useful in relation to our manufacturing and commercial interests. The Committee conclude with the following words:—"A few hundreds annually would probably suffice to hold together a body of trained observers which has no equal in the world, and which, once broken up, could not be replaced, since irrespective of the difficulty of training new observers, the continuity of the old observations would be destroyed."

Mr. R. Scott, F.R.S., called attention to the valuable results obtained by Dr. Angus Smith, F.R.S., who has analysed samples of rain-water collected in various parts of England. The rain as it falls dissolves

and brings with it many of the impurities contained in the air of the district, and therefore the analysis detects the foreign substances present in the air.

The President of the section (Mr. J. Clerk Maxwell, F.R.S.) pointed out that unless considerable care was taken in the collection of the samples, delusive results would be obtained.

Mr. Scott was understood to explain that Dr. Angus Smith provided the collecting glasses, &c., so as to obviate error from that source.

Several other gentlemen addressed the section.

Mr. Symons, in the course of his reply to the various speakers, mentioned the fact that, even by the coarsest tests, sea-spray might be detected mingled with the rain twenty, thirty, or even forty miles from the coast. He expressed his conviction that the rainfall observers throughout the country would cheerfully assist Dr. Angus Smith, with whom he would himself communicate on the subject.

*(To be continued.)*

### AURORA BOREALIS.

*To the Editor of the Meteorological Magazine.*

SIR,—I forward you a sketch of the aurora borealis as I saw it, about 9.30 p.m., on the 24th September. The northern horizon was fringed with non-luminous cloud; above this was an irregular luminous band, out of which streamers extended upwards, and patches of luminous matter shot rapidly up to the zenith, and even to within some 60° of the southern horizon, resembling fragments of white mist driven by a northerly gale. The wind, however, was southerly. I could see the time by my watch by the light of the aurora. I am told that the display was even more splendid at 12.45 a.m., after which it suddenly disappeared. It was, however, very bright again for a short time the next evening.—Yours, &c.,

FENWICK W. STOW.

*Hawsker, Whitby.*

### SOLAR RADIATION.

*To the Editor of the Meteorological Magazine.*

SIR,—I think we all owe a debt to Mr. Nunes for having discovered the possibility of two solar thermometers in vacuo by different makers differing by so large an amount in their readings, although both have an inch of the stem blackened. At the same time, I see no reason for supposing that such a difference is at all common, though the fact of its existence shows, that to obtain strictly comparable results we ought to compare the instruments previously in the sun's rays. I have recently compared one of Negretti's with mine, which is by Casella, and found the difference to be 1°·5, a difference which might easily result from Negretti's thermometer having a considerably larger bulb, which would, necessarily, expose a smaller surface in proportion to its bulk than a smaller bulb; moreover, a large bulb is less sensitive than a small one. Again, Messrs. Burrow, of Malvern, send me observations taken with a solar thermometer, which on comparison I find reads 2°·6 lower than mine. Thus, we have three good makers within 3°. And to shew how closely instruments by the same maker agree, permit me

to quote the following figures. (A, is my own instrument, B, that of a friend going out to India, E, excess of B over A) :—

		A		B		E	
July	28	.....	118·5	.....	118·5	.....	0·0
„	29	.....	118·5	.....	118·5	.....	0·0
„	30	.....	76·0	.....	76·0	.....	0·0
„	31	.....	117·0	.....	117·0	.....	0·0
Aug.	1	.....	92·	.....	92·	.....	0·0
„	2	.....	118·0	.....	118·2	.....	0·2
„	3	.....	121·0	.....	121·3	.....	0·3
„	4	.....	96·5	.....	96·2	.....	—0·3
„	5	.....	123·0	.....	123·2	.....	+0·2
„	6	.....	123·8	.....	124·0	.....	0·2
„	7	.....	123·8	.....	124·0	.....	0·2
„	8	.....	121·3	.....	122·0	.....	0·7
„	9	.....	127·0	.....	128·0	.....	1·0
„	10	.....	126·0	.....	126·5	.....	0·5

The two thermometers were both placed at 4 feet above the ground, six inches or more apart.

I shall be glad to learn what is the effect of imperfect exhaustion of the jacket, and to what cause the extraordinary difference between Pastorelli and Casella is to be attributed.

With regard to the second point raised by Mr. Nunes, I cannot see what we should gain by using thermometers in vacuo to indicate the temperature in shade. Though very sensitive to the sun's rays, they are not very sensitive when used as ordinary thermometers, with which, however, they will agree in perfect shade. Last May I proposed to Mr. Griffith to test the experimental stands by suspending on each a thermometer with blackened bulb, which ought to agree with the unblackened instrument if not exposed to any reflected or radiated heat from the ground or the atmosphere. For this purpose it would not be necessary to use thermometers *in vacuo*: but, anyhow, I am glad it is to be tried. I have lately become convinced that the effect of reflected and radiated heat is more considerable than I supposed. I am obliged, in fact, to condemn my own thermometer stand in the form in which it has been tried at Strathfield Turgiss. Profiting by the suggestions of different friends, I have altered it as follows:—The “bottom board” is removed, except a strip six inches wide through which the post passes, and this strip is raised two inches. In front of this strip the thermometers are hung, with their bulbs only just, if at all, below the lowest part of the louvred front. At the back the louvre boards are carried a few inches lower than before. A board, eight inches wide, is screwed to the boards on which the maximum and minimum thermometers are hung, passing immediately beneath all the bulbs, and cutting off all reflection or radiation from the ground. An outer roof is added, which may be made of rustic work, a space of two inches being left between the two. A louvred door is added in front. I own I was surprised to find the maximum on the altered stand frequently 2° lower than on one of the original construction. Probably in its altered form it gives readings approaching more nearly those of the



Stevenson than the Glaisher stand. Its appearance is, in my opinion, improved, and its cost (about 15s.) probably very little increased. I suppose it will be allowed that reflected and radiated heat do not form a part of the true temperature of the air. This reminds me that people speak of the *true amount of solar radiation*. Will you permit me to remind your readers that *there is not and cannot be any such thing?* All measurements of solar radiation are relative, depending on the relation of the rapidity of the reception of heat by radiation to the rapidity of its loss by conduction, convection, or radiation. You cannot have any test of it that is not arbitrary. The earth itself is only a large bulb surrounded by a peculiar envelope, which, happily for us, consists of air and not of a glass jacket containing a vacuum. The question is not "Is it the right amount of radiation?" but "Does the amount shewn increase or diminish with the intensity of the solar rays?" and "Will these instruments always and all of them shew the same amount for the same intensity?"

I am, Sir, your obedient servant,

FENWICK W. STOW.

P.S.—From what I hear from Mr. Nunes, the small size of the jacket, as well as the large size of the bulb, may have *something* to do with the comparatively low temperatures registered by Pastorelli's solar thermometers. It is evident we ought to have a standard pattern, and standard dimensions. A small jacket generally implies thick glass, and thick glass must absorb a greater proportion of the sun's rays than thin glass.

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### ALTITUDE ABOVE SEA LEVEL.

I HAVE purposely used the word "altitude" instead of "height," thinking that it will be a convenience if the term height could be reserved for the elevation of a gauge above the ground, and altitude for the elevation of the ground above the sea. Should the suggestion be good, it will eventually be adopted; if it is not good, it will doubtless be consigned to the oblivion it merits. This, however, by the way. The object of the present note is to ask all observers who are in any uncertainty as to the altitude of their stations, to notify the same to me, by postal card or otherwise, *before the end of October*. I am sure that many of the altitudes given in *British Rainfall* are incorrect, and I regret it. On the other hand, I know that many, the majority, are correct, and that if they *all* were, the altitudes of the 1500 stations quoted in that work would be of considerable utility in many enquiries. I am as willing to do what I can to increase the accuracy of the altitudes as to forward any other branch of the work, and the only stipulation is, that enquiries on the subject must be sent in at once.

G. J. SYMONS.

62, Camden Square, London, N. W.

## REVIEWS.

*Quarterly Weather Report of the Meteorological Office; with Pressure and Temperature Tables for the Year 1869.* Published by the authority of the Meteorological Committee. Part I., January—March, 1869. Stanford. 4to, 73 pages, 37 plates.

(Continued from page 111.)

WE have already spoken in high praise of the above work; we add thereto the expression of our opinion that to all who wish to study the wind and weather changes of the north-west of Europe, it is indispensable.

It is impossible in the limits of a review to thoroughly discuss the mass of information it contains, for be it remembered that it gives *continuous* records of the barometer, thermometer (dry and wet), direction and velocity of the wind, at seven observatories for three months—the curves being reproduced in fac-simile and on a rather contracted scale, ten degrees Fahrenheit being represented by 0·375 in., one inch of the barometer by 0·75 in., and 24 hours by about  $1\frac{1}{4}$  in. The lithographs are, however, so clearly printed that magnifying power may be employed if desired.

As a specimen of the accuracy of the work we have taken the Kew observations of the storm of Feb. 12th, 1869, which many of our readers may recollect, and which was noticed in these pages\* and also elaborately by Mr. Glaisher.†

We interpret the records as showing that the barometer fell to 29·29 in. (= 29·33 at sea-level) at 4.10 p.m., that the temperature fell from 50°·2 at 4.20 p.m. to 38°·2 at 4.50 p.m., and the wind veered from S.W. to N.W. between 4.10 and 4.20 p.m. Reference to Mr. Glaisher's paper will show that the storm travelled from W. to E. at a mean rate of about 35 miles an hour. Kew Observatory is about 8 miles W. of Camden Square, therefore changes at Kew should have been about 13 minutes earlier than at Camden Square. Then we have—

From the *Meteorological Magazine*, Vol. IV., p. 23—

Min. of. bar. at Camden Square ..... 29·318 at 4.15 p.m.

From the curves—

Min. of bar. at Kew... ..... 29·33 at 4.10 ,,

Observed difference ..... -·012 + 5 minutes.

Difference due to position ... +13 ,,

Wind reached N.E. at Camden Square ..... at 4.40 p.m.

,, ,, N.W. at Kew ..... at 4.20 ,,

Observed difference ..... +20 minutes.

Difference due to position ... +13 ,,

Again, Great George Street, Westminster, is about  $7\frac{1}{2}$  miles E. of Kew; then we have—

Change of wind to N.N.W. at Westminster..... 4.35 p.m.

,, ,, N.W. at Kew ..... 4.20 ,,

Observed difference ..... +15 minutes.

Difference due to position ... +12 ,,

\* Vol. IV., p. 21.

† *Proc. Met. Soc.*, Vol. IV., p. 294.

Mr. Cator's anemometer at Beckenham is  $12\frac{1}{2}$  miles E. of Kew Observatory ; from his account we have—

Wind reached N.W. at Beckenham at .....	4.55 p.m.
„ „ N.W. at Kew .....	4.20 „

Observed difference .. .....	+35 minutes.
Difference due to position ...	+23 „

Lastly, Greenwich Observatory is 13 miles E. of Kew, and—

At Greenwich the fall of temp. began at .....	4.45 p.m.
At Kew „ „ „ .....	4.20 „

Observed difference .. .....	+25 minutes.
Difference due to position ...	+24 „

The decrease of temperature was—

Harrow .....	48°	to	37°	.....	=11°
Westminster ...	49°	to	37°	.....	=12°
Camden Square.....	50°·2	to	37°·8	.....	=12°·4
Greenwich .....	—	to	—	.....	=11°
Dunmow.....	47°·5	to	33°	.....	=14°·5
Kew .....	50°·2	to	38°·2	.....	=12°

We cannot conceive any necessity, as far as what may be called storm meteorology is concerned, for greater accuracy than is here shown by the concurrent testimony of instrumental records and ordinary observation, and we doubt if the Committee themselves are aware not only of the great precision attainable, and at Kew actually attained, but of the reliability of the reduced and printed results.

That portion of the report which gives a sort of chronicle of the weather is on the whole satisfactory, but it suggests an idea which may be worth mentioning. In order fully to understand the weather on any given date, the reader requires—*first*, the reduced barograms, thermograms, and anemograms given in this report ; *secondly*, the notes on the weather and general distribution of pressure, &c., also given in this book ; but *thirdly*, he requires the daily weather table issued by the office, and printed in the *Times* and some other papers. Nothing is more compact and legible than the report as printed in the *Times*, but we cannot say the same of the folio form lithographed by the Committee ; if they had the tables set up in ordinary type, for immediate distribution, they could be stereotyped and, reprinted in the quarterly report, they would render it even more complete than at present.

It would of course be very unfair to complain that arrangements made in 1867 do not meet the *possible* requirements of 1870 or 1871, but the Committee promise to give in future issues of the *Quarterly Weather Report*, tables of periodic corrections, “and thereby to afford information as to daily range in various parts of the United Kingdom.” We hope that before committing themselves to such a publication, they will carefully consider the influence of position on their thermometers, for we think they will find that the amplitude of the daily range at some of their stations is thereby diminished 5 or 10 per cent. Having previously suggested that engravings of the instruments *in situ*

would be very useful, and such engravings not having been given, we leave that point, and proceed to test the thermometric tables given in this report, and we will confine ourselves to the English observatories Falmouth, Stonyhurst, and Kew. The only elements given in the present publication are the mean temperature of each month, and the highest and lowest readings. As, however, the first of these is unaffected, or nearly so, by contracted daily range, and the only mode of exhibiting the remarkable character of the extreme readings recorded, is by comparison with proximate stations, and we cannot *prove* them to be correct, although we believe them so to be, we must content ourselves with a comparison of the twin records at Stonyhurst, where there can be no doubt of the quality of the observations.

MONTHS.	Photographic.			Self-Registering.			Difference.		
	Max.	Min.	Range.	Max.	Min.	Range.	Max.	Min.	Range.
January .....	51·8	28·3	23·5	53·2	26·7	26·5	+1·4	+1·6	-3·0
February .....	56·3	30·8	25·5	57·5	31·8	25·7	-1·2	-1·0	-·2
March .....	48·2	27·9	20·3	49·4	27·6	21·8	-1·2	+·3	-1·5
April .....	73·1	32·9	40·2	73·2	32·9	40·3	-·1	·0	-·1
May .....	60·3	36·2	24·1	63·0	34·4	28·6	-2·7	+1·8	-4·5
June .....	72·5	41·0	31·5	75·0	39·7	35·3	-2·5	+1·3	-3·8
July .....	80·5	43·8	36·7	83·3	43·7	39·6	-2·8	+·1	-2·9
August .....	83·2	36·8	46·4	86·0	36·0	50·0	-2·8	+·8	-3·6
September.....	68·8	44·3	24·5	70·4	42·9	27·5	-1·6	+1·4	-3·0
October.....	71·0	30·0	41·0	72·8	28·2	44·6	-1·8	+1·8	-3·6
November .....	53·0	27·4	25·6	53·5	26·0	27·5	-·5	+1·4	-1·9
December .....	54·6	14·3*	40·3	55·0	13·4	41·6	-·4	+·9	-1·3
			31·6			34·1	-1·6	+·9	-2·5

\* Marked as doubtful, but evidently correct.

The above table shows that at Stonyhurst the mean monthly range is reduced from 34°·1 to 31°·6, and the annual range from 72°·6 to 68°·9, or seven and five per cent. respectively.

Falmouth compared with the proximate stations of Helston and Truro, gives far more startling contrasts, and even Kew and Greenwich often differ 4° or 5°; for instance, in June, 1869:—

	Max.	Min.	Range.
Kew.....	82°·0	40°·6	41°·4
Greenwich .....	87°·5	35°·6	51°·9
Difference .....	+5°·5	-5°·0	10°·5

We do not presume even to think which is more probably correct, but we do consider it unsatisfactory for the two leading authorities in meteorological matters to differ so widely.

*Remarks on Clinical Thermometers.* By CORNELIUS B. FOX, M.A.  
[Reprinted from the *Medical Times and Gazette.*] Theakstone,  
Printer, Scarborough, 12mo, 12 pp. 1869.

POINTS out the necessity for sending clinical thermometers of every description, and by whomsoever made, to Kew Observatory for verification, in which recommendation we fully concur.

## SEPTEMBER, 1870.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 101 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.					Deg.	Date.	Deg.	Date.
								inches.	in.				
I.	Camden Town .....	2.00	—	.26	.41	7	9	74.0	28	37.6	15	0	0
II.	Maidstone (Linton Park).....	2.08	—	.14	.83	7	7	77.0	26	38.0	15§	0	0
III.	Selborne (The Wakes).....	2.39	—	.05	.94	5	8	...	...	31.9	25	1	4
III.	Hitchen .....	1.63	—	.23	.48	5	9	68.0	2	36.0	24	0	...
IV.	Banbury .....	1.33	—	1.04	.37	13	11	70.0	2, 27	32.0	25	0	...
IV.	Bury St. Edmunds (Culford).....	1.58	—	.03	.41	13	11	72.0	2	32.0	15	0	3
V.	Bridport .....	.99	—	1.33	.39	8	9	72.0	28*	37.0	1	0	0
"	Barnstaple .....	2.04	—	1.72	.44	7	12	75.0	30	42.5	21	0	0
"	Bodmin .....	2.17	—	1.50	.46	9	10	71.0	29	44.0	1, 21	0	0
VI.	Cirencester .....	1.22	—	1.64	.38	2	7	...	...	...	...	0	...
"	Shiffnal (Haughton Hall) ...	.70	—	1.25	.16	13	13	67.0	2	35.0	15	0	...
"	Tenbury (Orleton) .....	1.25	—	1.43	.29	13	11	72.8	26	33.5	15	0	2
VII.	Leicester (Wigston) .....	1.60	—	.61	.55	14	9	76.0	27	35.0	14	0	...
"	Boston .....	.90	—	.67	.41	13	9	72.1	2	37.4	16	0	2
"	Grimsby (Killingholme) .....	1.43	—	...	.40	13	20	68.0	9	39.0	15	0	...
"	Derby .....	1.13	—	1.21	.30	5	11	71.0	27	37.0	25	0	...
VIII.	Manchester .....	2.66	—	1.03	.57	13	14	73.0	26	35.0	15	0	0
IX.	York .....	1.18	—	1.15	.31	13	14	71.0	2	32.5	15	0	0
"	Skipton (Arncliffe) .....	2.90	—	2.06	.66	13	13	70.0	29	29.0	11	2	...
X.	North Shields .....	.99	—	.71	.30	2	12	67.2	20	38.0	15	0	0
"	Borrowdale (Seathwaite).....	12.00	—	1.21	...	...	...	...	...	...	...	...	...
XI.	Cardiff (Town Hall) .....	...	—	...	...	...	...	...	...	...	...	...	...
"	Haverfordwest .....	2.75	—	.96	.93	5	6	68.2	29	36.0	3, 29	0	...
"	Rhayader (Cefnfaes).....	3.11	—	.73	.54	13	12	69.0	...	37.0	...	...	...
"	Llandudno .....	2.18	—	.16	.62	12	14	74.7	28	42.7	15	0	0
XII.	Dumfries .....	2.89	+	.16	.57	4	14	68.5	23	35.0	15	...	...
"	Hawick (Silverbut Hall) ...	1.97	...	...	.57	4	12	...	...	...	...	...	...
XIV.	Ayr (Auchendrane House) ...	3.87	+	.14	1.12	1	15	70.0	22	34.0	15	0	0
XV.	Castle Toward .....	3.80	—	.82	1.07	1	15	69.0	23	37.0	15	0	0
XVI.	Leven (Nookton) .....	2.47	—	.01	.83	9	14	66.0	5†	34.0	15	0	...
"	Stirling (Deanston) .....	3.15	0.00	.36	.13	15	15	67.2	17	31.0	15	1	3
"	Logierait .....	3.54	...	...	1.13	1	13	...	...	...	...	...	...
XVII.	Ballater .....	2.36	...	...	1.00	9	9	69.5	23*	30.0	15	1	...
"	Aberdeen .....	2.10	...	.59	.13	13	13	67.0	29	39.7	9	0	7
XVIII.	Inverness (Culloden) .....	2.10	...	.85	.14	12	12	64.0	23	39.7	15	0	2
"	Portree .....	6.25	—	4.52	1.65	4	19	...	...	...	...	...	...
"	Loch Broom .....	4.68	...	.95	.13	17	...	...	...	...	...	...	...
XIX.	Helmsdale .....	3.42	...	1.02	1	15	...	...	...	...	...	...	...
"	Sandwich .....	3.30	—	.36	1.03	1	18	64.0	19	38.6	9	6	0
XX.	Cork .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Waterford .....	2.36	—	.77	.72	4	19	69.0	16	47.0	11	...	...
"	Killaloe .....	3.66	—	.50	.92	1	18	74.0	22	31.0	21	1	...
XXI.	Portarlington .....	2.95	—	.33	1.35	2	24	70.0	28	38.0	10	0	...
"	Monkstown .....	...	...	...	...	...	...	...	...	...	...	...	...
XXII.	Galway .....	3.51	...	.73	1	16	69.0	19	35.0	29	0	...	...
"	Bunninadden (Doo Castle) ...	3.59	...	...	...	...	67.0	19	37.0	12	...	...	...
XXIII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...	...
"	Waringstown .....	2.74	...	.62	1	17	74.0	21‡	40.0	10**	0	0	0
"	Strabane (Leckpatrick) .....	3.78	..	.91	9	19	70.0	22	35.0	6¶	0	4	...

\*And 29. †And 8, 21, 25, 30. §And 16. ||And 24. ¶And 11, 27. ‡And 28, 29. \*\*And 14, 29.  
 + Shows that the fall was above the average; —that it was below it.

## METEOROLOGICAL NOTES ON SEPTEMBER.

ABBREVIATIONS.—Bar for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

## ENGLAND.

CAMDEN TOWN.—Heavy dews and misty mornings and evenings, but brilliant sunshine and most enjoyable weather, from the 13th to the end; particularly warm during the last week. T and heavy R in evening of the 3rd; lunar halos on the 4th and 11th; .05 of dew during the dry time; N.W. gale on 10th.

LINTON PARK.—R on 2nd, 3rd, 6th, 7th, 9th, 10th, and 13th, and high wind on 10th, but the last fortnight exceedingly fine, dry, and bright sunny days, with heavy dews at night. Wind chiefly E. and N.E.; bar. high and steady during that time; T and heavy R on 3rd; dense fog on 16th; fog on morning of 22nd.

SELBORNE.—Frequent R till the 13th, after which time, bar. varied very little; the range between the 18th and 25th did not exceed .4 of an inch. Aurora on 3rd was extremely bright and beautiful, but was exceeded by that on the 24th, which was the most beautiful I ever saw; it extended from S.W. to N.E., but there were no corruscations. The light was sufficient to show objects for a considerable distance. There was a diffused aurora on the 25th, and again on the 26th; fog on every day of the last week, which, when condensed in gauge, measured not less than .03 in.

HITCHEN.—Singularly dry month; very high bar.; heavy fogs every morning; frequent auroræ at night; wind N. in morning, E. in afternoon and evening.

CULFORD.—T on 3rd, and very high wind on the 10th and 11th, more particularly on the former day, which made sad havoc in the orchards and fruit gardens of the eastern counties, denuding many of the trees of their entire crop. No R. has fallen since the 17th, and the latter half of the month has been remarkably warm and summer-like in its character, each morning being ushered in by a heavy fog, which gradually cleared off, and was succeeded by a day of the brightest sunshine, with wind from S.E. and bar. above 30 in.

BRIDPORT.—Rather stormy the first part of the month, with south-westerly gale on the 9th; no R fell after the 13th; brilliant aurora on the 24th at 10.45 p.m., and also at 9 p.m. on 25th; bar. very high at the end of the month.

BODMIN.—Average bar. for month, 30.10; average temp., 59°·6; the drought most severely felt.

CIRENCESTER.—September further realized the character that has marked the whole year since January—the prevalence of N. and E. winds, and extreme dryness, with summer heat in the days and cold nights, the sky being almost cloudless night and day. Water getting very short, and (4th October) no apparent change at hand.

SHIFFNAL.—The month opened with a good prospect of returning verdure from the R which fell so generally for the first fortnight; after that, the drought returned with parching E. wind, which dried us up again. Bar. remarkably steady from the 18th to the 27th, the variation being only .05 during that interval; wind westerly from 1st to 15th—quite a gale on the 10th—then easterly to the end; mornings thick fogs or misty from the 18th, which somewhat relieved the drought, although followed each day by a cloudless sky; condensed fog at end of month, .03; distant T in S.W. on 6th; the air alive with aphides, which come from the turnips (17th); by the 24th the swede turnips annihilated by them and mildew, as bad as in 1865; mangold wurzel the only root crop uninjured; mushrooms abundant on 8th; blackberries abundant on 10th; damsons and walnuts in great profusion on 18th.

ORLETON.—R fell in small quantities on 11 days out of the first 13, which partly restored the green of the pastures, but did not penetrate the land to any depth; the remainder of the month was dry, with a very high and steady bar.; fogs very frequent in the mornings, but the day generally very brilliant, and the air calm. At the end of the month the pastures again becoming brown, and the swedes drying up. T heard on 6th and 7th; aurora on 3rd and 24th; swarms of winged ants on the 18th, and the air filled with aphides for many days at the close of the month.

WIGSTON.—The last fortnight of the month has been remarkable for the brilliance of the days, the sky having been nearly uniformly cloudless, preceded by a thick fog at daybreak; the pastures at the end of the month nearly as short of grass as in January; extensive blight upon the turnips and cabbages; a splendid aurora on the night of 24th.

GRIMSBY.—Remarkably fine month; although small quantities of R fell on several days, more is greatly needed; much fog and gossamer; many webs of the garden spider, the usual accompaniment of settled fine weather at this season; at the latter part of the month the bar. was unusually high and steady; T, L. and R at 6 p.m. on 7th; T at 6.15 on 9th; high wind on 9th from S.S.W., and on 10th from W.S.W., W., and N.W.; lunar corona on 12th; max. fall of R on 13th; rime on 15th; aurora on 24th, and fine one at 8.20 on 25th.

DERBY.—The slight but refreshing rains which fell in the early part of the month wonderfully freshened the pastures, but no R has fallen since the 13th, and bar. is still high; the weather has been all that could have been desired had the previous months yielded the usual fall of R instead of less than half; as it is, the drought is more sustained than that of 1868, but the temp. rather lower than in that remarkable year.

ARNCLIFFE.—No R for the last 14 days of the month, which is very unusual. Bar. very high and steady during that time.

NORTH SHIELDS.—Fine from 14th to end; lunar halo on 12th; aurora on 4th, 24th and 25th.

#### W A L E S.

CEFNHAES.—No R for the last 13 days; nights frosty, with heavy fogs; bright, hot, sunny days; wind generally S.E. or N.E.

LLANDUDNO.—The latter part of the month, from the 18th, has been one continuation of brilliant summer weather; bar. never below 30.250, and on the 30th, 30.500.

#### S C O T L A N D.

DUMFRIES.—The first half of the month showery, the latter half remarkably fine, resembling June; mean temp. 55°.2; days warmer and nights colder than average; on the evening of the 3rd a singularly beautiful display of the northern lights; harvest completed in the lower districts by the beginning of the month, and in the higher districts by the end of the month.

SILVERBUT HALL.—First half of the month wet and windy, second half most charming and summer-like weather. Sharp frost and thin sheeting of ice on the night of the 14th; fine aurora on the 24th; heavy gale on 9th.

AUCHENDRANE.—This month, as a whole, has been a period of unfavourable weather, although the fine weather after the 17th may be held to compensate for the bad before that date. Both 4th and 5th had been stormy from the S.W., and the aurora was seen early on the 4th, but the "Captain's" gale of the 7th did not reach here till the 9th, when, at 9 a.m., the bar. and ther. (which had previously been very unsteady) stood at 28.96 and 56°, and a violent gale from S.W. and N.W. with dreadful squalls prevailed throughout the day. The other great event of the month was the second aurora, which commenced at 9 p.m. on 25th, and continued with great brilliancy over the whole sky till 4.15 a.m. of 26th; rivers still very low, but the fogs by day and the dews by night are very persistent.

CASTLE TOWARD.—Wet and rather stormy to the 16th, then dry, mild, and foggy to the end of month; fogs frequent close to the Clyde, while it was bright 60 feet above it; gales on the 4th and 9th; aurora very bright from 9 to 12 p.m. on 24th. Turnips and pastures good; potatoes getting diseased; vegetables still plentiful, and flower gardens quite gay.

NOOKTON.—Within .01 of average.

DEANSTON.—First half of month wet, and several days of high wind; latter half of month, very bright sunshine, very calm, but a good deal of fog, mornings and evenings.

LOGIERAIT.—Very wet and cold during the first half of the month, afterwards bright and warm throughout the day, with heavy mists and a tendency to frost during the nights.

**BALLATER.**—Much R during the first half of the month, after the 15th none fell, the latter half being very fine and dry, with a tendency to frost. A reliable person here reports that on Saturday morning, the 1st of October, about half-past 3 o'clock a.m., she was alarmed by her room being brilliantly lighted up, and upon looking out of the window to ascertain the cause, observed lying on the ground, a small round ball about the size of a large marble or crystal bowl, as she described it, apparently in a glow of heat, but which presently disappeared. She did not look for it at the time nor in the early morning, and later in the day she thought it would be of no use as it is in a public street. By the time she got out of bed and looked out, the light had faded. This looks a fabulous tale, but the person is confident of what she saw, and is a person of good sound sense. What could it have been?—J. P.

**ABERDEEN.**—A fine mild month; rather damp during the first half, and very dry during the last fortnight; auroræ on 13 nights; T on 6th and 7th; fog on 16th, 28th, 29th, and 30th.

**PORTREE.**—First fortnight wet and stormy, which retarded harvesting very much, but in general the crops are all secured in good condition; all kinds of crops are above the average in this island, in fact it is very seldom they are as good; in some places, however, two-thirds of the potatoe crops are diseased, and fit only for swine.

**LOCHBROOM.**—The R which commenced on the 28th of August (after an almost unprecedented drought of months) continued, without one day's cessation, until the 16th, since which date we have had the finest weather that could be desired; indeed, the heat this day (October 1st) is something almost unbearable, at times and in some spots it is like the air from a furnace. The harvest produce is securely housed and stacked, but it is much feared the potatoe disease is making sad havoc among the small crofters and on shallow soil.

**SANDWICK.**—This has been one of the driest Septembers I have ever seen; since the 18th, particularly, it has been warm and dry, with moderate wind, so that harvest has been concluded under very favourable circumstances, and now (October 1st) the bar. stands at 30·566, so we have hopes of the fine weather continuing. Strong winds on 3rd and 4th; auroræ on 3rd, 15th (very red), 17th, and 31st; sea roaring on 22nd, must have been a storm in the Atlantic, but not here; lunar rainbow on 10th.

#### I R E L A N D.

**LECKPATRICK.**—First half of month wet and stormy. Gale from S.W. all day on 9th; much damage done to ungathered crops, many trees blown down, roofs stripped, &c.; wind fell at sunset; bar. rose rapidly during the night. Last 10 days fine. Rainfall a little above average.

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### METEOR ON SEPTEMBER 28TH.

*To the Editor of the Meteorological Magazine.*

SIR,—About 7.30 p.m. on Wednesday, September 28th, I observed an exceedingly brilliant meteor in the western sky. I am not certain that I saw the whole of its course, as, when I caught sight of it, I had just passed a house standing on the west side of the road, but, assuming that I noticed its first appearance, it started from a point in the head of Bootes, and burst after taking an almost vertical path of  $10^{\circ}$  or  $12^{\circ}$  towards the horizon. Its colour was white, and its size about one-sixth of the moon's apparent diameter.—Yours faithfully,

T. B. ARMITSTEAD.

*Hutton House, Burton, Westmoreland, Oct. 1st, 1870.*

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Several communications unavoidably postponed till next month.